Eskom National Transmission Company South Africa ™	**Specification**	**NTCSA**

Title: **Simmerpan DC Workshop and Battery room Refurbishment Technical Specification**

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1. INTRODUCTION

The DC Workshop and Battery room area is used for the pre-commissioning of batteries at different voltage levels within Eskom NTCSA, Telecommunication and Distribution divisions. The Battery room, which is classified as a Hazardous Location, is currently not complying with the Occupational Health and Safety Regulations. The intent is to refurbish the DC Workshop and Battery room in order to comply with the regulations thereby allowing the facility to be used for its intended purposes.

Figure 1: Location of the building at Simmerpan housing the DC workshop and Battery rooms

2. SUPPORTING CLAUSES

2.1 SCOPE

The scope of this document is limited to the area mentioned at Simmerpan and the required interfaces where applicable.

2.1.1 Purpose

The purpose of the Technical Specification is to specify the necessary technical requirements for the works of the project that is to be carried out by a *Contractor*.

2.1.2 Applicability

This document shall apply to NTCSA, TRE and specifically the rooms as indicated in section 3.1.1.

2.2 NORMATIVE/INFORMATIVE REFERENCES

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] 240-46177186: Eskom Battery Room standard

[2] 240-56360034: Stationary Vented Lead Acid Batteries Standard

[3] 240-56227516: LV Switchgear and Control Gear Assemblies and Associated Equipment for Voltages up to and Including 1000 Vac and 1500 Vdc

[4] 240-55714363: Eskom Generation Power Station Lighting and Small Power Installation standard

[5] 240-70164623: Eskom Heating Ventilation and Air Conditioning (HVAC) Design Guideline

[6] 240-143112846: Heating Ventilation and Air Conditioning System Design Work Instruction

[7] 240-102547991: General Technical Specification for HVAC Systems Standard

[8] 240-54937439: Fire Protection/Detection Assessment Standard

[9] 240-54937450: Fire Protection & Life Safety Design Standard

[10] 240-54937448: Fire Detection & Life Safety Design Standard

[11] National Building Regulations and Building Standards Act No. 103 of 1977

[12] SANS 10108: The classification of hazardous locations and the selection of apparatus for use in such locations

[13] SANS 10139: Fire Detection and Alarm Systems for Non-Residential Premises – System Design, Installation and Servicing

[14] 240-46264031: Fibre Optic Design & Installations - Substations

[15] SANS 10400-A The Application of the National Building Regulations Part A: General

[16] SANS 10400-T The Application of the National Building Regulations Part T: Fire Protection

[17] SANS 10400-O: The application of the National Building Regulations Part O: Lighting and ventilation

[18] SANS 10114 -1: Interior Lighting Part 1: Artificial lighting of interiors

[19] SANS 10142-1: The wiring of premises Part 1: Low-voltage installation

[20] SANS 10147: Refrigerating systems including plants associated with air-conditioning systems

[21] SANS 10173: The installation, testing and balancing of air-conditioning ductwork

[22] SANS 1424: Filters for use in air-conditioning and general ventilation

[23] SANS 1238: Air-conditioning ductwork

[24] SANS 193: Fire dampers

[25] Eskom Simmerpan DC Workshop Lighting design report

[26] ANSI Eyewash Z358.1-2014 In-Depth Compliance Guide/Checklist

2.2.2 Informative

[27] 240-53665024: Engineering Quality Manual

[28] 240-53114026: Project Engineering Change Management Procedure

[29] 240-53114002: Engineering Change Management Procedure

[30] 240-53113685: Design Review Procedure

[31] 240-49910707: Detail Design Report Template

[32] 240-8673501: Engineering Drawing Standard

[33] ISO 9001 Quality Management Systems

[34] OHS Act 85 of 1993 (Occupational Health and Safety Act)

2.3 DEFINITIONS

Definition	Description
Contractor	The primary *Contractor* who will be responsible for the entire Project Works
Employer	Refers to NTCSA a subsidiary of Eskom Holdings State Owned Company
Heating, Ventilating, and Air Conditioning (HVAC)	Relates to Systems that perform processes designed to regulate the air conditions within buildings for the comfort and safety of occupants. HVAC Systems condition and move air to desired areas of an indoor environment to create and maintain desirable temperature, humidity, ventilation and air purity.

2.3.1 Disclosure Classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 ABBREVIATIONS

Abbreviation	Description
AC	Alternating Current
AHU	Air Handling Unit
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Airconditioning Engineers
BMS	Building Management System
CO2	Carbon Dioxide
COC	Certificate of Compliance (Electrical)
COC	Certificate of Compliance or Conformity (HVAC)
DB	Distribution Board (Electrical)
DB	Bry Bulb (HVAC)
DC	Direct Current
DX	Direct Expansion
ECSA	Engineering Council of South Africa
EN	European Norm
ESKOM	Electricity Supply Commission (South African utility company) also see NTCSA
EXN	Explosion-proof (rated for hazardous locations)
EXTR 1	Extraction route 1 - ducting
EXTR 2	Extraction route 2 - ducting
EXTR 3	Extraction route 3 - ducting
EXTR 4	Extraction route 4 - ducting
FACP	Fire Alarm Control Panel
FFL	Finished Floor Level

Abbreviation	Description
FPDA	Fire Protection Detection Assessment
GA	General Arrangement
H_2	Hydrogen
HAZLOC	Hazardous locations
HVAC	Heating, Ventilation, and Air Conditioning
IP	Ingress Protection
IS	Intrinsically Safe
ISO	International Organization for Standardization
LED	Light Emitting Diode
LV	Low Voltage
MCP	Manual Call Point
MERV	Minimum Efficiency Reporting Value
NEC	National Electrical Code (or contract-specific term)
NTCSA	National Transmission Company of South Africa (Also see Eskom)
NiCad	Nickel-Cadmium
OBD	Opposed Blade Damper
OEM	Original Equipment Manufacturer
OHS	Occupational Health and Safety
P&ID	Piping and Instrumentation Diagram
PH120	Fire-rated cable specification
PFD	Process Flow Diagram
Pr. Eng / Pr. Tech. Eng	Professional Engineer / Technologist with ECSA, for authorization of all design work (Or any recognized engineering body Washington/Australia Accord))
PSIRA	Private Security Industry Regulatory Act (56of 2001) for fire detection installation and commissioning
SAQCC	South African Qualification and Certification Committee – For HVAC Installations and Commissioning
SANS	South African National Standard
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
TRE	Transmission Real Estate
USB	Universal Serial Bus
Vac	Volts Alternating Current
Vdc	Volts Direct Current
VDSS	Vendor Document Submission Schedule
VRLA	Valve Regulated Lead Acid
WB	Wet Bulb
ΔT	Temperature Difference

2.5 ROLES AND RESPONSIBILITIES

Refer to the 240-53113685 Design Review Procedure.

2.6 PROCESS FOR MONITORING

The primary process for monitoring will be governed by the Design Review Procedure (240-53113685), this entails assuring that the design achieves the requirements set out in this document. Any changes to this document will be performed as per Project Engineering Change Management Procedure (240-53114026).

2.7 RELATED/SUPPORTING DOCUMENTS

[35] 2025/04: Eskom Simmerpan Electrical Inspection – Complete Battery Lab Electrical Installation

[36] 363-ERE-AABZ4-D00221-1: Simmerpan Direct Current (DC) Workshop Fire Protection / Detection Assessment

3. TECHNICAL SPECIFICATION

3.1 TECHNICAL REQUIREMENTS

The technical requirements, as detailed in this specification document, and accompanying drawings and standards, comprise of the engineering work, the provision of all labour including materials and *Contractor's* equipment, manufacturing, supply, delivery, off-loading, hoisting, erection, testing, balancing, and commissioning to serve and guarantees.

The engineering, quality control, inspections, plant and material selection, preparation of installation drawings, testing, balancing, commissioning, and preparation of operating and maintenance manuals, are to be managed and executed by the *Contractor* in a systematic manner as follows:

a) Detailed Design (as specified)
b) Plant and material selection
c) Installation drawings (as-built drawings)
d) Plant installation
e) Testing (pressure, leak and evacuation), balancing, and commissioning documentation
f) Quality control
g) Operating Instruction and Maintenance Manuals for all systems
h) Inspection Record Cards/Checklists and final hand-over
i) Relevant documentation (B6) from SAQCC for HVAC works for installation and commissioning, etc.
j) Relevant documentation from PSIRA for fire detection works for installation and commissioning, etc.
k) Issuing of Certificate of Compliance (COC) for electrical works
l) Issuing of Certificate of Conformity (COC) for HVAC works
m) Hazloc classification and documentation

3.1.1 Details of Plant

DC Workshop and Battery rooms are located within the Eskom Simmerpan Complex in Germiston, Johannesburg and its buildings are over 75 years old. The scope of work is relevant to the following facilities inside the building:

- Workshop and Battery charger training room
- Battery room and Live Battery storeroom
- Distilled Water room
- Nicad Battery room
- Electronic card storeroom
- Sulphuric acid storeroom
- Storeroom in DC workshop

- Equipment storeroom. This room will be used as the fresh air supply and house the air conditioning units for the battery room. This room will further on be known as the Air Handling room in the document

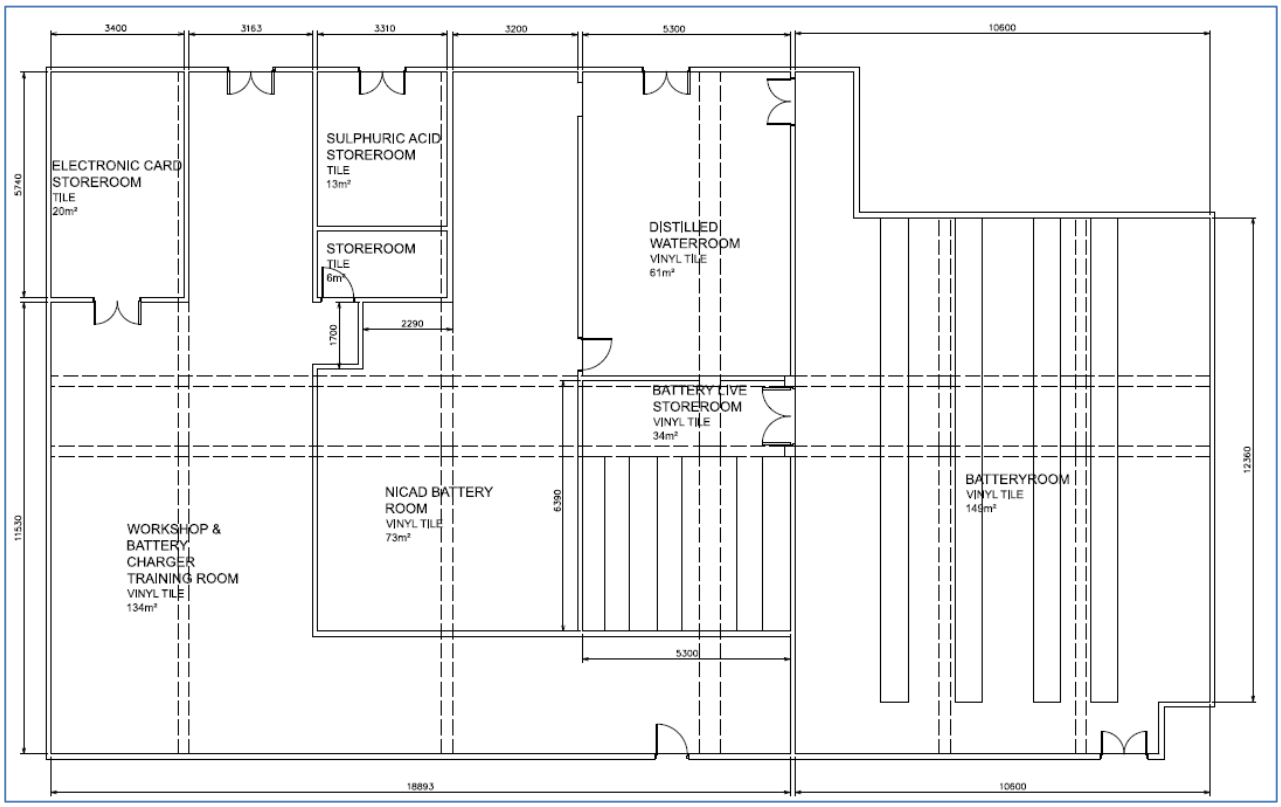

Figure 2: Layout of rooms inside the building

Figure 3: Photo of the Battery rooms

3.1.1.1 Details of HVAC Plant

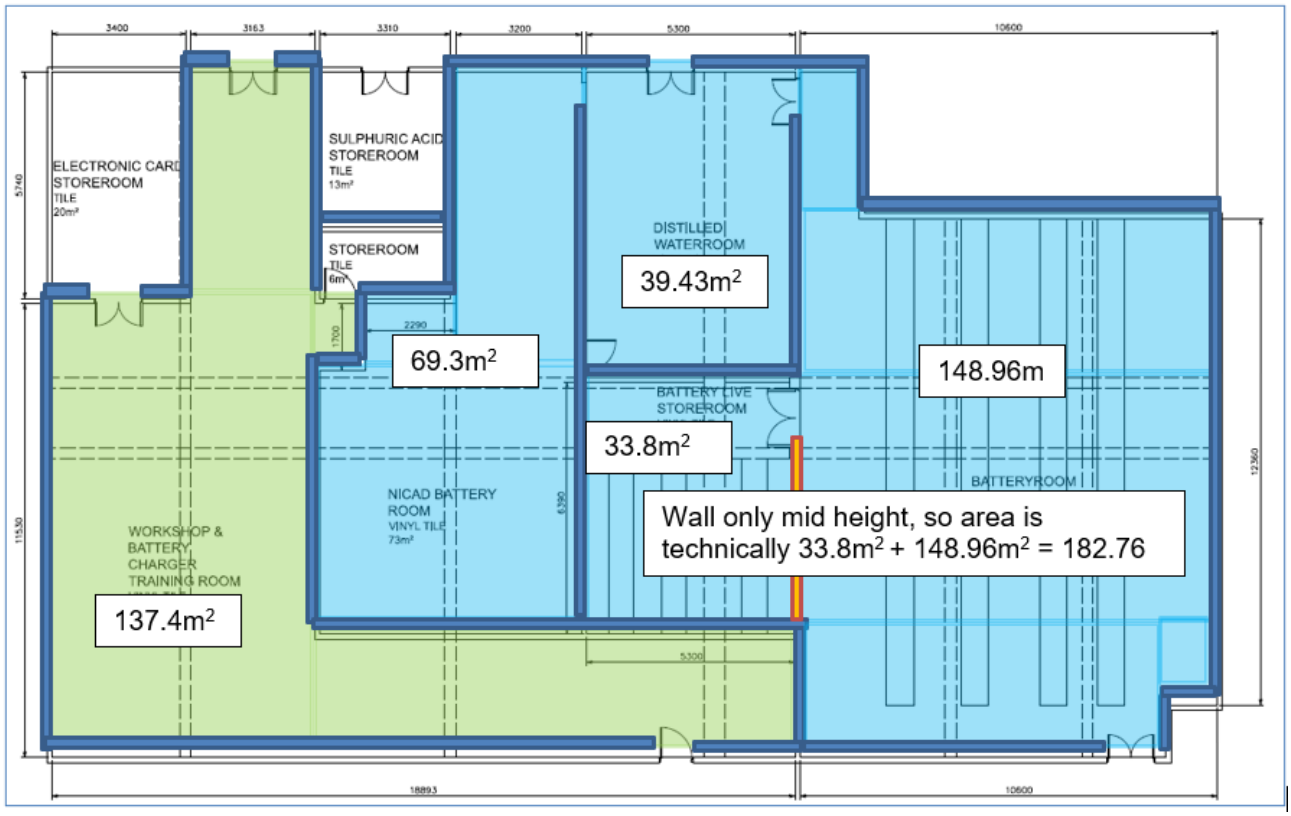

Figure 4: DC Workshop (Green) and Battery Room (Blue) – Area sizes

In Figure 4 above, the area sizes of the various rooms are given. The dark blue and the orange colours are indicating walls and the half wall. Note that the "Battery Live Storeroom - Area 33.8 m^2" is in the battery room, and the wall indicated in orange colour is only a half wall, meaning that the area can be seen as one as the wall doesn't go up to ceiling level.

The green area consists of:

- Workshop and Battery charger training room
- Electronic card storeroom
- Sulphuric acid storeroom
- Storeroom

The blue area consists of:

- Battery room and Live Battery storeroom (seen as one)
- Distilled Water room
- Nicad Battery room

Red area, as explained on the next page:

- Air Handling room
- Electronic card storeroom
- Sulphuric acid storeroom
- Storeroom

In the Figure 5 and Figure 6 the same applies as stated above, but the following is added:

- Red areas – Those areas that have not been accessed, no cooling/heating is required there, but in the Air Handling room shares the same extraction system (Extr 2), and that part of the extraction system (ducting) also needs to be cleaned. It will further also be used to house the new fresh air, air-conditioning system.
- Yellow areas indicate the beams of support for the floor/roof. These, together with the walls form pockets/open voids (honeycombs) where H_2 (hydrogen) can accumulate at ceiling height. Extraction is required at each of these pockets. During a fire this is where smoke will accumulate and hence smoke detectors are required as well.
- Pink indicates the ducting system of the extraction fans, there are 4 different systems.
    - "Extr 1" – In battery room.
    - "Extr 2" – In battery room, and in the red area not accessed.
    - "Extr 3" – In battery live storeroom (with mid-wall section), and in the Distilled water-room.
    - "Extr 4" – In NiCad-battery room.

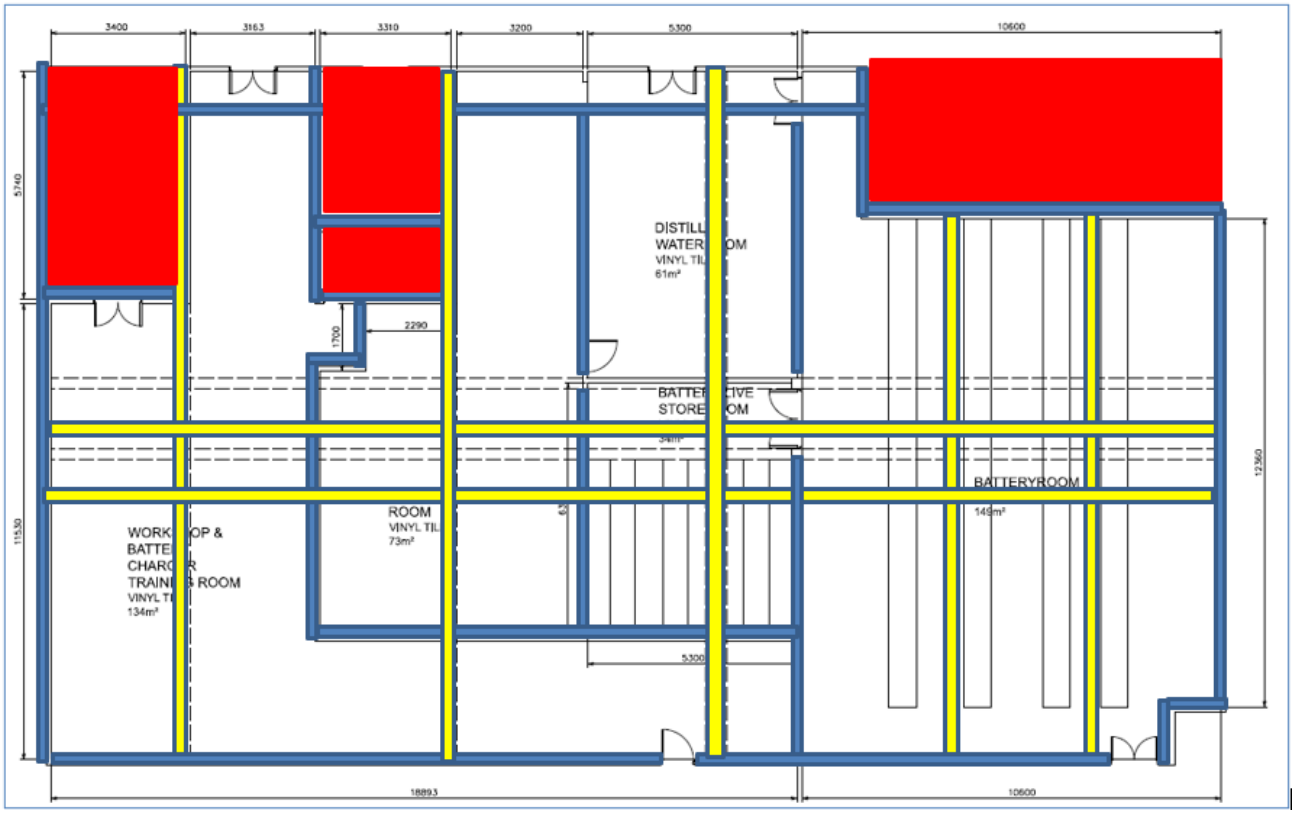

Figure 5: DC Workshop, Battery Room, and other rooms – beams & walls forming pockets

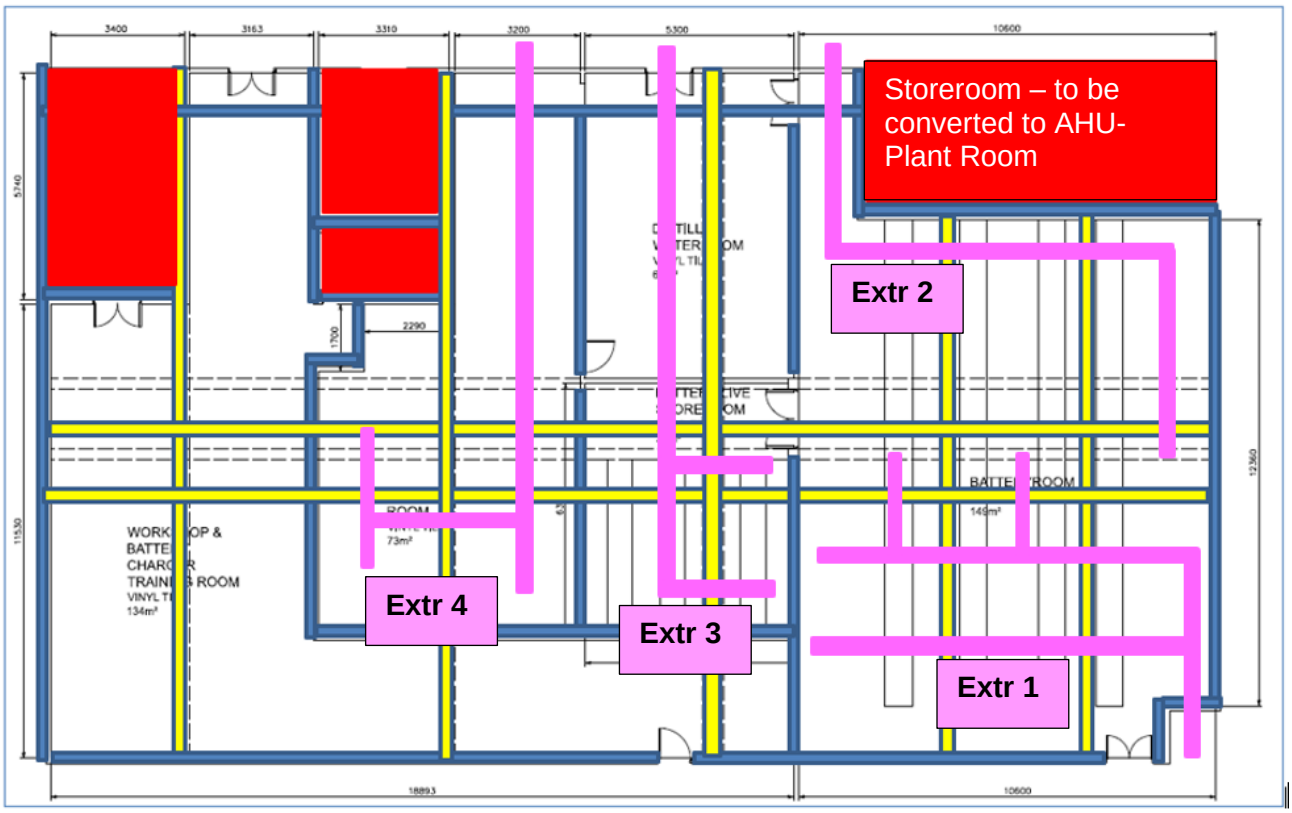

Figure 6: Extraction System – Ductwork layout – 4x off systems (Pink)

The HVAC plant is old. A lack of plant performance is evident as the necessary cooling capacities are not available in the DC workshop, which have resulted in high room temperatures that are above the acceptable levels. Simmerpan Complex is an important strategic transmission and distribution site for day to day running of Eskom operations, and it is crucial to get the air conditions in working order.
The high indoor temperatures can result in an uncomfortable environment for personnel and intermediate failures of the electronic equipment. Therefore, new generation Direct Expansion (DX) air conditioning systems to meet the environmental conditions required for successful operation is required in the DC workshop, and a new generation DX (fresh air) handling unit in the Battery room.

3.1.2 Scope of Works

The high-level scope of work entails the following:

- Battery room (including storeroom), Electrical, HVAC, Mechanical and Fire detection design
- DC Workshop (including storerooms), Electrical, HVAC and Fire detection design
- Decommissioning of existing lighting fixtures, trunking and lighting circuits in all rooms
- Decommissioning of existing DC bus reticulation system
- De-commissioning of existing battery monitoring system
- Demolishing of the existing brick battery stands in the Battery room and Battery Live storeroom
- Removal of floor and wall tiles in the Battery room and Battery Live storeroom
- Closing of the existing windows in the Battery room
- Floor preparation in the Battery room and Battery Live storeroom

- Floor protection in the Battery room and Battery Live storeroom
- Paint the Battery room and Battery Live storeroom walls with acid resistant paint
- Supply laminated pine battery stands as per list of required battery bank sizes
- Installation of new DC cables and battery terminal stands that would allow the charging and discharging of six (6) battery banks simultaneously in the Battery room
- Installation of new DC cables and battery terminal stands (floor or wall mounted) that would allow one 220 Vdc battery bank or two (2) 50 Vdc battery banks to be kept on float charge in the Battery Live storeroom.
- Installation of new DC cables and battery terminal device that would allow one (1) VRLA battery bank to be charged and kept on float in the DC Workshop room
- Design a manual switch or link configuration to allow flexibility between the 6 battery chargers and the 9 battery banks
- Perform a load assessment to determine if the existing AC supply configuration to the Workshop Distribution board (DB) is adequate and upgrade where required (including LV supply cable, Minisub feeder circuit breaker, etc.)
- Existing Workshop DB to be replaced with a floor standing DB with separate sections for domestic and equipment circuits.
- Installation of new lighting fixtures and wiring as per Eskom Simmerpan DC Workshop Lighting design report
- Installation of new lighting fixtures and wiring in the Air Handling room
- Installation of new cable racks, trays, etc.
- Replacement of all existing domestic sockets and wiring
- Provide fixed AC termination of the Battery room battery chargers to the new Workshop DB
- Rewiring of the existing Training battery chargers. Each charger to be supplied from an individual feeder circuit at new Workshop DB
- The First floor DB is currently fed from the Workshop DB and provision must be made for a temporary supply to this DB when the Workshop DB is being replaced
- Design, supply, deliver, Installation, commissioning and handover of new HVAC system (New Generation DX Split units in the DC workshop and New Generation DX Air Handling unit, complete with ducting, fire dampers, grilles, HVAC electrical and control systems, inclusive of panels and cabling, etc. in the battery room.)
- Installation of new Fire Detection System
- Design, supply and install a new battery water system in the Air Handling room
- Replace existing doors with fire-rated doors (battery room only)
- Replace the three (3) existing Safety shower and eye wash basins
- Installation of new washing basin (location to be confirmed)
- Wall preparation, including removing of tiles (where indicated) and interior painting of all remaining rooms in accordance with Eskom Corporate Identity colours
- Deep cleaning of all the remaining floors
- Labelling and signage

- HAZLOC classification and documentation
- Issue of electrical and mechanical COC for the entire installation
- Provide spare light fittings (5% of the installed lighting fixture types)
- Documentation management

3.1.3 Electrical Design Requirements

3.1.3.1 Battery room and floor construction

Design of the rooms shall comply with the requirements as specified in [1]. This includes, but not limited to:

a) Removal of floor and wall tiles in the Battery room and Battery Live storeroom
b) Closing of the existing windows in the Battery room
c) Floor construction
d) Floor protection
e) Labelling and signage as per [1]

Refer to the table below indicating the quantity and capacity of the cells that needs to be taken into account when designing the battery room floor.

3.1.3.2 Battery stands and battery terminal devices

a) New Battery stands shall be sized, made of laminated pine and comply with the requirements as specified in [2].
b) Design must be optimised to allow a range of battery cells (voltage and capacity) to be charged at the same time. Minimum clearances around the battery stands must be maintained. The table below indicates the range of battery banks to make provision for:

Table 1: Range of battery banks to make provision for

Number of banks	Battery type	Bank Voltage	Number of cells per bank	Capacity of cells	Location of battery bank	Activity to be performed
2	Vented Lead-acid	50 Vdc	25	3809 Ah	Battery room	Initial charge and discharge test
3	Vented Lead-acid	220 Vdc	108	1525 Ah	Battery room	Initial charge and discharge test
1	Vented Lead-acid	110 Vdc	54	1525 Ah	Battery room	Initial charge and discharge test
1	Vented Lead-acid	220 Vdc	108	1525 Ah	Battery Live storeroom	Kept on float charge

2	Vented Lead-acid	50 Vdc	25	3809 Ah	Battery Live storeroom	Kept on float charge
1	VRLA	48 Vdc	4 x 12Vdc	100 Ah	DC Workshop room	Charging and kept on float

Table 2: Battery dimensions and weights

Battery Type	Capacity (Ah)	Length (mm)	Width (mm)	Height (mm)	Weight (kg)
17 OSP.HC 1445	1525	215	277	710	107.4
36 OSP.HC 3780	3809	215	580	815	274.9

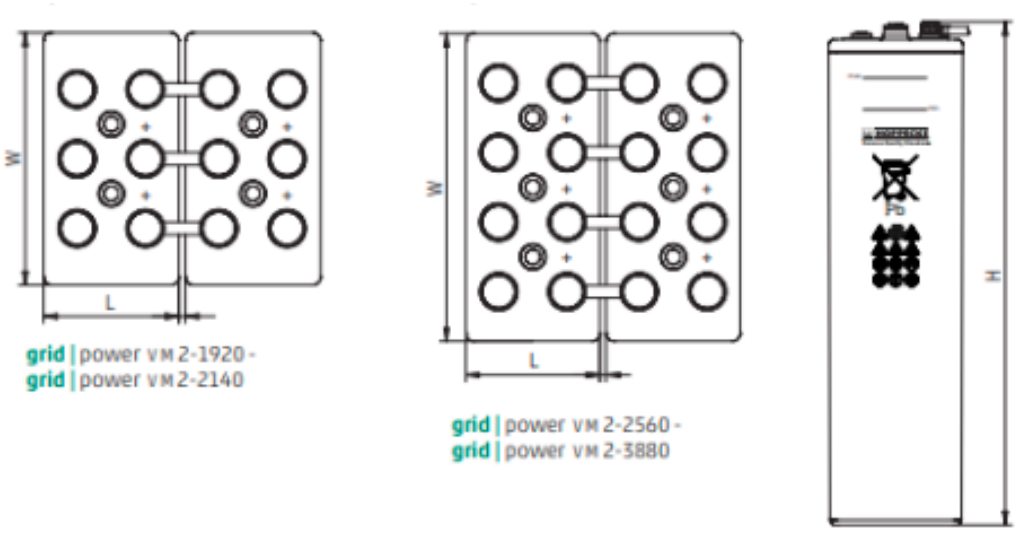

Figure 7: Battery cell layout

c) Battery cells are installed edge-to-edge as per figure above.
d) Final positioning of the battery stands to be optimised to ensure that the cells are not positioned directly above the light fixtures.
e) Installation of new DC cables and battery terminal stands (floor or wall mounted) that would allow the charging and discharging of six (6) battery banks simultaneously in the Battery room. DC cables are to be sized to also allow for the discharge of the battery banks from the DC Workshop room.
f) Installation of new DC cables and battery terminal stands (floor or wall mounted) that would allow one 220 Vdc battery bank or two (2) 50 Vdc battery banks to be kept on float charge in the Battery Live storeroom.

g) Installation of new DC cables and battery terminal device that would allow one (1) VRLA battery bank to be charged and kept on float in the DC Workshop room.
h) Six chargers (Eskom to provide), situated in the DC Workshop room, are used to charge the different battery banks. Details of the chargers are indicated in the table below:

Table 3: Battery charger details

Number of chargers	Voltage rating	Current rating
2	50 Vdc	300 A
2	110 Vdc	200 A
2	220 Vdc	200 A

3.1.3.3 Manual switch or link board configuration

a) Design a manual switch or link board configuration to allow flexibility between the 6 battery chargers and up to nine (9) battery banks (6 vented lead-acid battery banks in the Battery room, one (1) or two (2) vented lead-acid battery banks in the Battery Live storeroom and one (1) VRLA bank in the DC Workshop room).
b) This selection must be done from the DC Workshop room and clearly labelled at the link board and at the battery banks.
c) The switch or link board configuration must provide adequate protection against short-circuit currents.

3.1.3.4 DC Workshop room

a) Perform a load assessment to determine if the existing AC supply configuration to the Workshop DB is adequate and upgrade where required (including LV supply cable, Minisub feeder circuit breaker, etc.).
b) Design a floor standing DB to replace the existing DB in accordance with [3].
c) DB design to make provision for separate sections for domestic and plant equipment circuits
d) Rewiring of the existing Training battery chargers. Each charger to be supplied from an individual supply circuit at new Workshop DB.

3.1.3.5 Lighting and small power

a) Replacement of all existing domestic sockets and wiring. Location of new socket outlets to be determined during design phase. Wiring to be done in accordance with [19] and [4].
b) Lighting installation to be done as per [25] and [4]. The proposed light fixtures to have an approved Luminaire Photometric test report issued by Eskom Research and Innovation Centre.
c) An additional lighting design is to be done by the *Contractor* for the Air Handling room (not included in the Eskom Simmerpan DC Workshop Lighting design report). Design is to comply with the requirements of [4] and [18] and ideally the same lighting luminaires as specified in the rest of the installation is to be used
d) Emergency lighting to be provided (with internal battery back-up).
e) Switched lighting circuits to be provided per room. Battery room and Battery Live storeroom lights to be switched from outside the Battery room.

f) Dual-technology Occupancy sensors to be installed in all rooms, except the Battery room and Battery Live storeroom.

3.1.4 HVAC Design Requirements

This section outlines the HVAC (Heating, Ventilation, and Air Conditioning) requirements for the DC Workshop, Battery Room, and associated Air Handling room.
The scopes for these are given in more detail in the following sections:
The *Contractor* does design work and calculations (including review of certain areas), as built drawings and philosophies for the work below. The *Contractor* supplies, installs and commissions all the systems.

3.1.4.1 Design Condition

a) Outdoor (Simmerpan, Germiston, Gauteng):
b) Summer: 35°C DB / 20°C WB
c) Winter: 1.1°C DB / -2.2°C WB
d) Elevation: 1,633 m

The HVAC system is to maintain indoor conditions as detailed by the table below, for 24 hr per day, 7 days per week, throughout the year (24/7/365).

Table 4: Indoor conditions

Area/Building	Indoor Temperatures	Relative Humidity	Pressurisation Requirements
1. DC workshop	22°C±2°C	N/A	N/A
2. Battery rooms	20°C (As per battery supplier's requirement)	N/A	*Extraction required, and slight negative pressure

3.1.4.2 DC Workshop (Ground Floor) scope:

a) Remove all existing HVAC components including indoor units, condensers, and piping. Restore affected areas.
b) Recalculate the heat load considering finalized equipment and internal gains. Inform the *Employer* of any revisions.
c) Install new-generation DX split units (cassette type) with a heat pump for cooling/heating two pipe system. Include:
    1. Cooling & heating
    2. Anticipate 10% future heat load growth.
    3. Five indoor cassette units: 2x four-way, 2x two-way, 1x three-way, each rated at 11Kw.
    4. Minimum coverage: 4 m radius per indoor unit.
    5. Maintain temperature at 22°C ±2°C.

6. One outdoor condenser unit, fenced with a lockable gate and concrete plinth with vibration damping material.

d) Natural ventilation is assumed adequate unless Contractor's calculations per SANS 10400 Part O indicate otherwise. If not sufficient, provide outdoor fresh air supply.
e) Equip HVAC system with:
    1. Central wired controller (controls all 5 units).
    2. External input for emergency shutdown.

3.1.4.3 Battery Room (Ground Floor) scope:

a) Provide 100% fresh air via new-generation DX AHUs (no recirculation allowed).
b) Required extraction via EXN-rated fans/motors
c) Complete hydrogen release and ventilation calculation based on worst-case battery charging scenario in compliance with SANS 10108.
d) Maintain constant room temperature at 20°C
e) Monitor humidity and temperature continuously (logging required).

3.1.4.3.1 Ventilation and Extraction Requirements

a) Install 4x EXN-rated fans (calculate airflow rate to ensure hydrogen remains <0.8% of free air volume).
b) Clean and assess existing ducting. If inadequate for new extraction fans:
    1. Install noise attenuators.
    2. Redesign ductwork per SMACNA/ASHRAE standards.
c) Ensure fans operate continuously during battery charging.
d) Label fan direction and EXN rating visibly on ducting, so that one can see it form the ground looking up.
e) Remove old grilles and Install grilles with fixed vanes and opposed blade dampers (OBDs).
f) Maintain extraction inlets at the highest points.

3.1.4.3.2 Smoke Extraction and Fire Interlocks

a) Interface HVAC system with fire detection.
b) On fire detection:
    1. Shut down all supply air systems.
    2. Maintain extraction to clear smoke and hydrogen.
    3. Battery chargers must interlock with airflow sensors.
    4. Battery chargers must interlock with smoke detectors (even if extraction fans are on, the chargers must be off, this one overrides the airflow sensor).
c) Manual override for post-fire smoke purge (be able to switch off/on fans as required during a fire from outside the battery room). Must have the required IP65 rating for rain and dust.
d) Provide 2-hr fire rating on penetrations and cabling where applicable.
e) No fire dampers in extract ducts; all equipment must be EXN-rated and fail-safe.

3.1.4.4 HVAC work inside the Air Handling room (Converted storeroom)

a) Clear and classify stored equipment (remove waste, retain reusables).
b) Remove existing tiles, lights, doors, wires, and HVAC equipment.
c) Modify room:
    1. Clean/repair walls and floors.
    2. Fill drain and wall duct holes.
    3. Plaster and paint.
d) Install:

1. Lockable double doors with weather louvre and filter.
2. Two 12 kW DX AHUs (one standby, one operating) with manual dampers and dual filter banks.
3. Condensers outside, fenced with a lockable gate and concrete plinth with vibration damping material.
4. Slight negative pressurisation (e.g., 80 l/s intake vs. 100 l/s extraction) as per contractor's calculation, 20% less air in than what is extracted.
5. Full fresh air once-through system (no recirculation).

3.1.4.5 Ductwork Requirements

a) Design ductwork to SMACNA and ASHRAE standards:
   1. Minimize fittings; use extended plenums.
   2. Design for leakage integrity (250–500 Pa).
b) Include:
   1. Duct layout with sizes, pressure drops, fittings, dampers, diffusers, and fire ratings.
   2. Duct insulation and vapour barriers where needed.
   3. Fire-rated ducting: welded steel, min 1.6 mm thick.
c) Distribute air to avoid outlets over electrical equipment.
d) Duct Sizing Methods
   1. Equal Friction (default): ≤6 m/s, 1 Pa/m pressure drop.
   2. Velocity Reduction: for simpler layouts.
   3. Static Regain: for large volume systems (>10 m^3/s).
e) Existing Extraction System – Review and Redesign
   1. Perform hydrogen extraction calculations.
   2. Review all four existing systems ("Extr 1–4") for adequacy.
   3. Replace grilles with fixed vanes and OBDs.
   4. Rebalance entire system.
   5. Full ducting specifications and sizes provided for reference.
f) Filtration System Design:
   1. Comply with:
      a. ASHRAE 52.1 (85% dust spot efficiency).
      b. ASHRAE 52.2 (MERV 13).
      c. EN 779-2011 Class F7.
   2. Filters to be cleanable and accessible.
g) Noise and Vibration Control:
   1. Use acoustic louvres, sound attenuators, flexible collars, and vibration isolation.
   2. Floor-mounted units: mount on 50 mm plinths with rubber pads.
   3. Wall-mounted units: use cantilever brackets with vibration isolators.

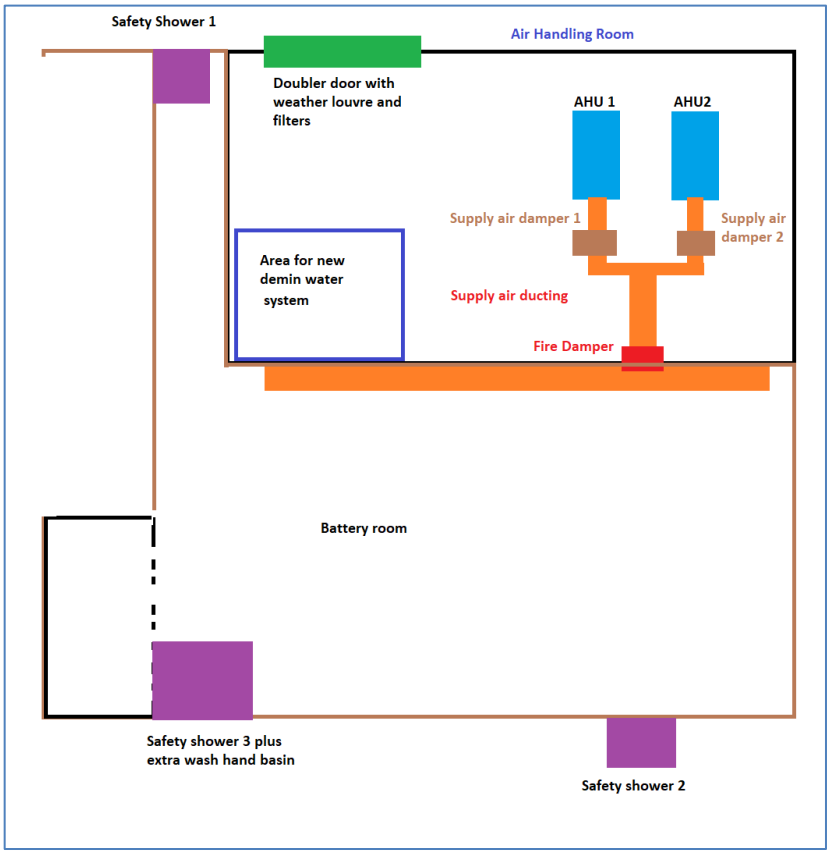

Figure 8: Schematic of AHU and Safety Showers in battery room (top view)

Details of ducting systems typed out below and summarised in Table 5

a. "Extr 1" – In big battery room.

- Grilles at extraction points:
  - 2x 200mm by 200mm plus ducting
  - 6x 300mm by 300mm plus ducting
- 150mm by 350mm (height by width) – 3.4m + 1.9m + 1.9m + 3m = (±)**10.2m (10200mm)**
  - Plus, 2x reducers from 150mm by 350mm to 200mm by 400mm
- 200mm by 400mm (height by width) – (±)**3m (3000mm)**
  - Plus, 1x reducer from 200mm by 400mm to 250mm by 400mm
- 250mm by 400mm (height by width) – 1.6m + 5m + 3.5m = (±)**10.1m (10100mm)**
  - Plus, 1x reducer from 250mm by 400mm to 350mm by 500mm
  - Plus, a 90-degree bend.
- 350mm by 500mm (height by width) – (±)**0.9m (900mm)**
  - Plus, conversion where fan is located (rectangular to circle to square) **2m (2000mm)** (Not accessed as it is in the ceiling).
- 600mm by 600mm (height by width) – (±)**2m (2000mm)**
  - Plus, a 90-degree bend.
- 500mm by 700mm (height by width) – (±)**4m (4000mm)**

- 300mm by 350mm (height by width) – 2x 5m = (±)**10m (10000mm)**
  - Plus, 2x 2x 45-degree bends (4 in total).
  - Plus, 2x 1x 90-degree bends (2 in total).
  - Plus, 2x grilles size not confirmed as this is on the roof.

b. "Extr 2" – In big battery room, and in the red area not accessed.

- Grilles at extraction points:
  - 1x 200mm by 200mm plus ducting
  - 3x 300mm by 300mm plus ducting
- 150mm by 350mm (height by width) – 3.8m + 2m = (±)**5.8m (5800mm)**
  - Plus, 1x reducers from 150mm by 350mm to 200mm by 400mm
- 200mm by 400mm (height by width) – 0.9m + 2.2m = (±)**3.1m (3100mm)**
  - Plus, 1x reducer from 200mm by 400mm to 250mm by 400mm
- 250mm by 400mm (height by width) – 2m + 3.5m = (±)**5.5m (5500mm)**
  - Plus, 1x reducer from 250mm by 400mm to 400mm by 500mm
  - Plus, unknown size and length of ducting from room not accessed.
  - Plus, conversion where fan is located (rectangular to circle to square) roughly 1.35m circumference **2.2m (2200mm)**
  - Grille for exiting air of 650mm by 650mm.

c. "Extr 3" – In big battery room, mid-wall section, and in the Distilled water-room.

- Grilles at extraction points:
  - 2x 150mm by 150mm plus ducting
  - 1x 400mm by 400mm plus ducting
- 100mm by 200mm (height by width) – 1.5m + 1.5m = (±)**3m (3000mm)**
- 150mm by 500mm (height by width) – 0.9m + 2.2m = (±)**2.8m (2800mm)**
  - Plus, 1x reducer from 150mm by 500mm to 250mm by 500mm
- 250mm by 500mm (height by width) – 1.6m + 0.2m +1m +0.8m= (±)**2.6m (2600mm)**
  - Plus, 1x reducer from 250mm by 500mm to 300mm by 500mm
  - Plus, grille of 350mm by 350mm in the reducer
- 300mm by 500mm (height by width) – 1m + 0.2m = (±)**3.75m (3750mm)**
  - Plus, special section lowering the total height of the duct while maintaining the same size of 300mm by 500mm). Duct length is 500mm over a horizontal distance of 450mm, to lower by approximately 218mm, from where the ducting continuous.
- 350mm by 500mm (height by width) -
  - Plus, conversion where fan is located (rectangular to circle to square) roughly 1.35m circumference (±)**2.2m (2200mm)**
  - Grille for exiting air of 650mm by 650mm.

d. "Extr 4" – In small (NiCad) battery room.

- Grilles at extraction points:
  - 5x 300mm by 300mm plus ducting
- 150mm by 300mm (height by width) – 1.6m + 1.65m + 1.5m = (±)**4.75m (4750mm)**
  - Plus, a section that combined two flows into 1, 2x90-deg Bends.
  - Plus, 1x reducer from 150mm by 300mm to 200mm by 350mm
- 200mm by 350mm (height by width) (±)**3.5m (3500mm)**
  - Plus, 1x reducer from 200mm by 350mm to 250mm by 350mm
- 200mm by 350mm (height by width) – 0.9m + 0.2m +3.68m= (±)**4.78m (4780mm)**
  - Plus, 1x reducer from 200mm by 350mm to 300mm by 450mm
- 300mm by 450mm (height by width) – (±)**2.5m (2500mm)**
  - Plus, special section lowering the total heigh of the duct while maintaining the same size of 300mm by 450mm). Duct length is 910mm over a horizontal distance of 900mm, to lower by approximately 135mm, from where the ducting continuous.
  - Plus, conversion where fan is located (rectangular to circle to square) roughly 1.33m circumference (±)**2m (2000mm)**
  - Grille for exiting air of 550mm by 550mm.

Table 5: Existing Extraction System Ductwork (Estimated)

Route	Grilles (Size & Qty)	Main Duct Sizes & Lengths (mm)	Reducers & Bends	Special Notes
Extr 1	2× 200×200 mm 6× 300×300 mm (1× 650×650 mm assumed, to be verified on roof)	150×350 mm: 10,200 mm 200×400 mm: 3,000 mm 250×400 mm: 10,100 mm 350×500 mm: 900 mm 600×600 mm: 2,000 mm 500×700 mm: 4,000 mm 300×350 mm: 10,000 mm	3× reducers 2× 90° bends 4× 45° bends	Conversion: rectangular → round → square at fan (2,000 mm in ceiling)
Extr 2	1× 200×200 mm 3× 300×300 mm 1× 60×650 mm	150×350 mm: 5,800 mm 200×400 mm: 3,100 mm 250×400 mm: 5,500 mm	3× reducers	Includes unknown ducting in inaccessible area Conversion at fan: 2,200 mm circumference
Extr 3	2× 150×150 mm 1× 400×400 mm 1× 350×350 mm (in reducer) 1× 650×650 mm	100×200 mm: 3,000 mm 150×500 mm: 2,800 mm 250×500 mm: 2,600 mm 300×500 mm: 3,750 mm	2× reducers Special drop: 500 mm length, 218 mm vertical drop	Conversion at fan: 2,200 mm circumference

Extr 4	5× 300×300 mm 1× 500×500 mm	150×300 mm: 4,750 mm 200×350 mm: 3,500 mm 250×350 mm: 4,780 mm 300×450 mm: 2,500 mm	3× reducers 2× 90° bends Special drop: 910 mm length, 135 mm vertical drop	Conversion at fan: 2,000 mm circumference

3.1.5 Other Mechanical Design Requirements

Supply and install a new wash basin in the battery room, with all associated pipework and fittings, next to the existing safety shower in the battery room at the eastern wall. Remove and supply and install 3 new safety showers and eye wash station.

a) The minimum reachable distance between any battery terminal and the nearest water outlet point shall be no less than 2000 mm
b) Potable water- used for the sink, eyewash and shower.
c) All water supplies shall be labelled.
d) All water supplied to the battery room shall be cold water.
e) Remove and replace all 3 existing safety showers/eye wash station and associated pipes and fittings with new safety showers and eye wash station and associated pipes and fittings, as per the latest revision of the Eskom battery standard [1] and the ANSI guide [26] and Appendix A: 0.54/1150

Design, supply and install a new battery water system in the Air Handling room, with all associated pipework and fittings (supply and drainage), and a 1000 litre tank on a stand at about 1.2 m from the ground, with a means of emptying it form the bottom, and start stop sensors when filling the tank from the battery water system. The *Contractor* ensures that the Pressure Equipment Regulations are adhered to and shows these in the design. Remove the existing battery water system in the Distilled water room and scrap it.

Details of the new battery water system:

The *Contractor* gives a design comparison of the following battery water systems with pros and cons to each, the *Employer* will then choose a system that the *Contractor* will supply and install.

a) Compare different battery water systems with each other and supply the *Employer* with the options indicating the cost and the pros and cons to each as well as the maintenance and operating requirements of each of the systems shown below for the requirements as pointed out later.
    a. Demineralised water (demin water) system
    b. Distilled water system
    c. Deionised water system
b) Estimated production capability of 1200 litre of water over a period of 5 days (10 litre per hour operation)
c) Water quality, and allows for a meter than can measure the conductivity (built in on the battery water system):
    a. Conductivity @ 25°C less than 10 µS/cm
    b. Silica (SiO_2) less or equal than 1.0 ppm
    c. Sodium (Na^+) less or equal than 1.0 ppm
    d. Chloride (Cl^-) less or equal than 5.0 ppm
    e. Sulphate (SO_4^{2-}) less or equal than 5.0 ppm
d) Drill hole in wall for battery water supply to the battery room and fit a valve.
e) Any control and instrumentation on the local panel/display as required.

f) All electrical requirements for the water battery system as required.

3.1.6 Fire detection Design Requirements

Details taken from Simmerpan DC workshop FPDA report [36].

Install an early warning fire detection system comprising of at least smoke detection and manual call points. The ceiling is concrete, divided into 3 rows and 2 columns of honeycomb partitions with struts deeper than 300 mm. This necessitates individual detectors in each of the partitions.

Details for each area follows, for design, procure and construct (install):

a) Detection of smoke shall hinder the supply of fresh air into the battery room.
b) Detectors shall be installed and maintained by a competent person as per SANS 10139.
c) All smoke detectors shall be mounted on the ceiling.
d) Alarms
    a. All battery room alarms shall be sent to the control desk at Zero Control
    b. All safety alarming and indication shall be fail safe, thus even when the detecting equipment fails then the alarm will be triggered.
    c. The following alarms are to be present where required:
        i. No/ limited airflow (Forced ventilation/extraction)
        ii. Smoke detection

Early smoke detection by aspirating system. Equipment within hazardous zones to be suitably (IS/EX) rated and maintained by qualified personnel. It is important to note that the ventilation system in these rooms are of paramount importance, and if it is fully functional according to the expected extraction of hydrogen, and airflow is monitored and alarmed then no hydrogen detection equipment is required.

3.1.6.1 Battery Room

a) Fit smoke detectors in the ceiling voids to detect smoke and fire in the area and alarm this at a central 24/7 manned control room (Zero Control) and, interface with the site wide fire detection system.
    1. There are at least 24 smoke detectors required.
b) Fit Manual Call Points (MCPs) at each of the entrance and exit doors and alarm this at a central 24/7 manned control room (Zero Control) and, interface with the site wide fire detection system.
    1. There are 2 doors
c) 4x sounders and strobe lights (combo)
d) Relevant fire signage
e) PH120 cabling between fire detection equipment (Fire panel, smoke detectors, MCP's, and sounders/strobe lights. Estimated 500 m of cable.

3.1.6.2 DC Workshop

a) Fit smoke detectors in the ceiling voids to detect smoke and fire in the area and alarm this at a central 24/7 manned control room (Zero Control) and, interface with the site wide fire detection system.
    1. There are at least 11 smoke detectors required (8 in the dc workshop area, and then 3 in the storerooms (one in each storeroom)
b) Fit Manual Call Points (MCPs) at each of the entrance and exit doors and alarm this at a central 24/7 manned control room (Zero Control) and, interface with the site wide fire detection system.
    1. There are 5 doors (the 2 entrance doors, and 2 storeroom doors inside the DC workshop and one storeroom door outside).
c) Fire Panel

d) PH120 cabling to Zero Control Building about 500 m of cable or Radio Link (as per SANS 10139) and receiver to Zero Control Building about 180 m of distance between receiver and sender (Whichever is most practical) to connect to mimic panel in the control room.
e) 2x sounders and strobe lights (combo)
f) Relevant fire signage
g) PH120 cabling between fire detection equipment (Fire panel, smoke detectors, MCP's, and sounders/strobe lights. Estimated 200 m of cable.

3.1.6.3 Air Handling room (Red area in battery room – refer to Figure 6)

a) Fit smoke detectors in the ceiling voids to detect smoke and fire in the area and alarm this at a central 24/7 manned control room. Possibly interface with the site wide fire detection system.
    1. There are at least 3 smoke detectors required
b) Fit a Manual Call Point (MCP) at the entrance/exit door and alarm this at a central 24/7 manned control room. Possibly interface with the site wide fire detection system.
    1. There is 1 door
c) 1x sounder and strobe light (combo)
d) Relevant fire signage
e) PH120 cabling between fire detection equipment (Fire panel, smoke detectors, MCP's, and sounders/strobe lights. Estimated 200 m of cable.
f) 2x CO2 fire extinguishers

3.1.6.4 Fibre optic cabling

Where fibre optic cables are used, the installation needs to comply with the requirements of [14].

3.1.7 Fire Protection Design Requirements

Details taken from Simmerpan DC workshop FPDA report [36]

Existing door assemblies to be removed and replaced with new fire rated door assemblies, that are constructed and tested for as per SANS 1253 (Automatic or self-closing door assembly which complies with the requirements, and which is especially constructed to prevent the passage of fire for a specific length of time).

Supply and install fire extinguishers with the relevant signage. Details for each area follows:

3.1.7.1 Battery Room

a) Remove exiting doors and replace with 2 hr fire rated door assemblies, Contractor to supply these.
    a. There are 2 double doors (one on eastern side and one on western side)
    b. There is 1 single door
b) Supply and install 2x 5 kg CO2 fire extinguishers at each door on the inside and on the outside (thus 8 fire extinguishers).
c) For cable going through walls, ensure coating/sealing is as per Section 3.1.7.4
d) Battery rooms in the following locations shall have a fire rating for paints, floors, ceilings, walls, roofs, cabling, ducts and doors as specified below:2hrs
e) Any duct, pipe, conduit, cable or other equipment that penetrates a wall, floor or ceiling, shall be fire sealed with a fire-resistant material in such a way that the fire resistance of the wall, floor or ceiling will not be negatively affected.
f) Ventilation ducting that passes through to adjacent rooms of the building shall have fire dampers installed to prevent fire from spreading to surrounding rooms.
g) The fire-resistant material used for filling holes in the wall shall be smooth and non-permeable to acid vapour

h) Battery room doors shall be equipped with an anti-panic bar door mechanism.
i) The doors shall be hinged, single action that opens outwards.
j) Each leaf shall be hinged by means of four hinges. The hinges shall be able to support the weight of the door.
k) The door and frame shall be given the same paint treatment as the walls.
l) Doors shall close and seal in such a way as to minimise dust ingress.
m) Battery room doors shall be lockable from the outside and every locking device fitted shall be suitable for the surrounding environment.
n) All doors shall have a closing mechanism.

3.1.7.2 DC Workshop

a) Remove existing doors and replace with new lockable doors.
    a. There are 3 double doors
    b. There is 1 single door
b) Supply and install 2x 5 kg CO_2 fire extinguishers at each double door.
c) For cable going through walls, ensure coating/sealing is as per Section 3.1.7.4

3.1.7.3 Air Handling room (Red area in battery room – refer to Figure 6)

a) Remove exiting doors and replace with a door that has a louvre and filters inside, this door will supply fresh air to the air handling units.
    a. There is 1 double door
b) Supply and install 2x 5 kg CO_2 fire extinguishers at the double door.

3.1.7.4 Fire Sealing and Fire Coating of Cables

Any conduits, cables, ducting etc. that penetrate fire rated walls, fire rated floors or any other fire barriers shall be sealed to maintain the integrity of the fire barrier. The material that is used for providing the fire seal shall have a fire rating (typically 2 hours) equivalent to the fire barrier. The material shall have a test certificate in accordance with SANS 10177 and the requirement for stability, integrity and insulation shall be met. The material being used shall have a test certificate that is no more than 5 years old, and the material shall be installed in accordance with manufacturer's recommendations.

Anywhere where electrical or control cables penetrate fire barriers the cables shall be coated with a fire rated coating on both sides of the penetration for at least 1 meter. The fire rated coating shall be in accordance with the fire barrier fire rating.

Fire rating applies to the structure, paint, floor, ceiling, roof, cabling, ducts, doors, walls, ceiling, sealants, and hole fillers.

3.1.8 Alarm Summary

The following table provides a summary of the alarms and annunciation.

Table 6: Alarm summary

Alarm type	Local display (Yes/No)	Remote alarming (Yes/No)
Fire detection (via smoked detectors)	Yes	Yes. To Zero Control building

HVAC	Yes	No
Battery water system	Yes	No

3.1.9 General Design Requirements

a) Design to be reviewed and approved by the *Employer* prior to starting of the Works
b) The equipment is to be designed to facilitate efficient manufacture, inspection, transportation, installation, maintenance, cleaning and repairs.
c) The equipment is to be designed to ensure safe and satisfactory operation for at least 15 years for Direct Expansion Units; under the conditions prevailing at Simmerpan, in Germiston, Gauteng Province, the same for fire detection/protection systems.
d) The equipment is to be designed to prevent undue stresses being produced by expansion and contraction due to temperature change and other local natural and manmade conditions.
e) The equipment is to be designed to keep maintenance costs to a minimum.
f) The equipment is to be designed to comply with all the legal requirements in respect of safety and the prevention of environmental pollution.
g) The equipment is to be designed to satisfy any specific requirements contained in the relevant statutory codes and standards.
h) The equipment is to be designed such that all material from which the equipment is manufactured from is compatible with the intended duty and service conditions. All equipment is suitable treated and protected from corrosion.
i) After the design freeze, the information stated in the data sheets is to be fully complied with through the installation, unless otherwise agreed upon by both *Employer* and *Contractor* in writing.

3.1.10 Manufacturing Requirements

Manufacturing of the equipment commences when drawings are accepted for construction, by the *Employer*.

The *Contractor* notes that all General Arrangement (GA) and detailed manufacturing and erection drawings become the property of the *Employer*.

3.1.11 Construction Requirements

The construction to be carried out in a systematically manner to avoid any complications during the *Works*.

3.1.11.1 Civil engineering and structural works

The civil, structural and building *Works* includes the following but not limited to:

a) Utilise the existing equipment supports where applicable. Load verification is to be carried out to ensure that the existing plinths are suitable for the new equipment.
b) Core drilling where necessary for all piping to protrude through the walls. Holes through structure and brickwork including timber frames and fire sealing off all rounds the pipework. The *Contractor* ensures that all openings created on load bearing walls do not compromise the structural integrity of the aforementioned walls. The *Contractor* ensures that all openings created do not compromise or impact any steel reinforcement existing in the structural walls.
c) Hoisting and rigging of equipment.
d) Supporting hangers and brackets for all associated equipment

3.1.11.2 HVAC Supports

Floor mounted HVAC equipment is to be mounted onto concrete plinth, which protrudes at least 50 mm above finished floor level. Vibration elimination rubbers are to be provided between HVAC equipment and the concrete plinth.

All piping and cabling is to be mounted onto cantilever brackets or equivalent means with vibration elimination rubbers provided between the units and the brackets.

Utilise the existing HVAC equipment concrete plinths and equipment supports. A structural integrity assessment is to be carried out by the *Contractor* to verify that the existing structures can support the HVAC equipment. The assessment report is issued to the *Project Manager* along with the relevant recommendations for acceptance. The Contractor conducts all remedial works as per the accepted assessment report.

3.1.11.3 Penetration of Pipe Work and Cabling Through Walls

The *Contractor* ensures that all openings created in the walls to accommodate pipe work and cabling are adequately secured to ensure that the existing fire rating of the building is maintained.

The *Contractor* ensures that all openings created on load bearing walls do not compromise the structural integrity of the walls. The *Contractor* ensures that all openings created do not compromise or impact any steel reinforcement existing in the structural walls.

3.1.11.4 Drains Connections

The *Contractor* provides drainage points where required.

3.1.11.5 Hoisting, rigging and moving of equipment and materials

The *Contractor* provides the following to complete the *Works*:

a) All scaffolding required
b) Any equipment necessary to complete the *Works*
c) Lifting facilities
d) Man-power required to temporarily move stored equipment and material when painting and preparing walls and floors

The *Contractor* supplies, installs, maintains, and removes all temporary construction facilities and utilities necessary to provide the *Works.*

3.1.11.6 Waste Management requirements

The *Contractor* provides dust sheets and everything necessary for clearing and removal of all rubble. The Contractor will be responsible for removal of all rubble from site.

Contractor will be responsible to remove all redundant material from site, as indicated by the *Employer*. This may include electronic equipment from the storage rooms as well as shelving units. Removal of redundant equipment will be done under supervision of the *Employer*.

3.1.11.7 Temporary works

The First floor DB is currently fed from the Workshop DB and provision must be made for a temporary supply to this DB when the Workshop DB is being replaced.

3.1.11.8 Survey and Site clearance

The design data specified in this specification and those dimensions shown on the tender drawings are intended for tendering purposes only. The *Contractor* is required to take the actual measurements onsite

before proceeding with design and manufacture of the *Works* as dimension accuracy remains the responsibility of the *Contractor*.

3.1.12 Commissioning Requirements

The *Contractor* does comprehensive pre-commissioning, commissioning as well as quality monitoring on all systems and is to provide a report with the following details. The installers and commissioners must have the correct accreditation (SAQCC, and others where needed).

3.1.12.1 HVAC Commissioning

The commissioning for the HVAC must contain the following as a minimum, as well as any instructions from the OEM (or OEM manuals).

3.1.12.1.1 Pre-commissioning checks (before the unit is powered on):

a. Installation Verification

- Indoor and outdoor units installed according to manufacturer guidelines.
- Proper mounting (level, stable, vibration-isolated).
- Correct orientation and spacing (especially clearance for airflow and maintenance access).
- Adequate drainage for condensate from indoor unit.
- Outdoor unit placed on vibration-isolated slab/bracket, with weather protection if required.

b. Piping and Electrical Checks

- Refrigerant piping (suction and liquid lines) correctly sized and connected.
- Leak testing of refrigerant lines (usually using nitrogen + soap bubble test or electronic detector).
    - 40 Bar Pressure test
    - 200 micron vacuum test
- Proper insulation of refrigerant lines.
- Power supply matches unit specification (voltage, phase, amperage).
- Circuit breaker and disconnect switch installed properly.
- Wiring (including communication wires) is secure and terminated per manufacturer diagram.
- Earth/ground connection confirmed.

3.1.12.1.2 Start-Up and Functional Testing (After the unit is powered)

a. Initial Power-On

- Power supplied and no error codes displayed.
- Remote control or thermostat functional.
- Communication between indoor and outdoor units verified.

b. Refrigerant and Pressure Checks

- System pressures (suction, discharge) within manufacturer specifications.
- Superheat and subcooling measured and within acceptable range (for non-inverter systems).
- For inverter systems, check manufacturer-specific diagnostics for operating parameters.

c. Airflow & Performance

- Indoor unit fan operation (all speeds tested).
- Outdoor unit fan and compressor operation.
- Supply and return air temperatures measured to confirm ΔT (temperature difference, typically 8–14°C in cooling mode).
- Check for unusual noise or vibration.

3.1.12.1.3 Controls and Modes Verification

- Unit responds correctly to cooling, heating (heat pump), dehumidification, and fan-only modes.
- Thermostat or controller responds correctly to setpoint changes.
- Timer functions, sleep modes, and auto-restart (after power failure) tested.

3.1.12.1.4 Battery Room HVAC System Commissioning

Commissioning to include but not limited to:

- Supply airflow balancing, including total air from AHUs to air on each outlet grille
- Even distribution of air in the room
- Room temperature of 20 degrees Celsius met as per requirements
- Supply airflow balancing, including total air extracted by fans
- Room pressurization i.e. negative pressure relative to adjacent spaces.
- Battery room extraction fan interface to battery chargers.
- HVAC interface to fire detection and response thereof
- Run and standby configuration change over in the event of failure of duty unit, confirmation of automatic change over.
- Run and standby change over test to balance running hours.
- Checking of Air Changes Per Hour against minimum of 10 ACH as per Eskom requirements for battery room.

3.1.12.2 Fire Detection/Protection Commissioning

The commissioning for the fire protection/detection must contain the following as a minimum, as well as any instructions from the OEM (or OEM manuals).

3.1.12.2.1 Fire detection:

a. Smoke detectors

- Confirm correct location per design (ceiling height, airflow, spacing).
- Power up and test for functionality using test smoke or aerosol.
- Check sensitivity (if adjustable).
- Confirm alarm signal is received at FACP (Fire Alarm Control Panel).
- Document test results and detector address/zone.

b. MCP's

- Confirm correct location per design (ceiling height, airflow, spacing).
- Proper mounting height (typically 1.2–1.4 m from FFL).
- Located along escape routes, stairwells, and exits (no more than 45 m apart).
- Glass or element must be easy to break or activate.
- Functionality tested (break glass/test key) and confirm signal at FACP.
- Clearly labelled and accessible (no obstructions).

c. Control Panel (Fire alarm) and Mimic Panel

- Confirm all zones, devices, and addresses are correctly programmed.
- Battery backup system tested (usually 24–72 hr capacity).
- Simulate alarms and faults to confirm response.
- Confirm printer or logging systems (if present) are functioning.
- All LEDs, buttons, buzzer indicators verified.
- Wiring from FACP confirmed and functional.
- LEDs light up corresponding to zone alarm/fault.
- Must reflect actual layout (updated floorplan).
- Visible and accessible to emergency responders.

d. PH120 Fire-Rated Cable

- Cables tested for continuity, insulation resistance.
- Installed in metal conduit or cable trays (per fire-rating design).
- Terminations checked for tightness and labelling.
- Fire-stopping/penetration seals verified.
- Verify fire rating certificate from cable manufacturer.

e. Sounders and Strobe Lights

- Minimum dB level at 1 m (typically 65–85 dB depending on environment).
- Strobe visibility tested from various angles.
- Confirm all devices activate during test alarm.
- Synchronization (if required).
- Power supply (current draw and backup) verified.

The commissioning procedure to be adopted is prepared by the Commissioning Authority. During commissioning the *Contractor* set the installation to work and competent personnel demonstrates and explain the operation and maintenance procedures for the installation and for each item of plant to the *Employer*. During commissioning if any item is found to be unsatisfactory the fault is rectified and/or new components fitted and commissioned by the *Contractor* at their own expense. The *Contractor* then rebalances and commission the system or part thereof affected at their own expense.

3.1.12.3 Electrical Commissioning

Commissioning shall entail the following:

- Functional testing of the manual switch or link board configuration witnessed by the *Employer* and the *Employer*'s representative. Safety clearance certificate to be issued and signed-off by all parties
- Simulation or functional testing (if new chargers are installed) of the airflow failure interlock protection
- Testing and verifying all electrical outlets including earth leakage testing
- Testing and verifying lighting circuits, switches and correct operation of occupancy sensors
- A competent person shall perform illumination measurements as recommended in [18]. Illumination measurement reports shall be produced and submitted to the *Employer*.
- Issuing of an electrical COC

3.1.13 Maintenance Requirements

a) Provide spare light fittings (5% of the installed lights per fitting type)
b) After completion of the contract, the *Contractor* is required to provide training and transfer system knowledge to the *Employer* by submitting documented Design Intent, As-built drawings, Operational and Maintenance Manual, Commissioning Records, Commissioning Report and by providing training on all the systems to the *Employer*'s personnel to ensure that they have all the information and understanding needed to operate and maintain the features and systems in the various areas.
c) The *Contractor* is to provide on-site training and training material to the *Employer*'s personnel prior to taking-over of the Works. The training is preferable to be offered during the commissioning and testing phase for a minimum of four (4) personnel. The *Contractor* is to, prior to handing over of the Works, satisfy the *Employer*'s personnel are competent and adequately trained to maintain and operate the equipment supplied.
d) The training is to cover the following, however not limited to:
    1. Review of controls set up, programming, alarms and troubleshooting
    2. Review of O&M manuals
    3. Maintenance requirements and sourcing replacements

The operating and maintenance manuals are to be available during the training of *Employer's* personnel.

The operation and maintenance manuals are to consist of the following as the minimum:

a) List of Contents (Index)
b) Introduction
c) General description of the functions of each of the Systems including detailed description of each element of each System, how it functions, how it operates and how to maintain it and what attic stock or tools to carry.
d) Full as-built drawings and detailed drawings, brochures and catalogues for each System and each element of each System.
e) The format of the O&M documentation is to be A4 and is to be a specially bound document with hard cover and with metal ring binding. (All drawings folded into A4 format.)
f) The names, addresses and telephone numbers/email addresses of all responsible persons and manufacturers/suppliers are to be listed in the O&M document.
g) A full list with reference numbers are to be included to enable the *Employer*s O&M staff to order materials and equipment.
h) Colour diagrams are be provided to illustrate the operation and function of each System with reference to the relevant as-built drawings or brochures of equipment. These diagrammatic drawings are to also indicate the locations of valves with their numbers.

3.1.14 Handover Requirements

a) Handover of all OEM manuals
b) Completed training and training documentation

3.1.15 Decommissioning Requirements

c) Decommissioning of existing lighting fixtures, trunking and lighting circuits in all rooms
d) Decommissioning of existing DC bus reticulation system in the Battery rooms, Air Handling room and Workshop and charger room
e) Decommissioning of existing battery monitoring system
f) Decommissioning of the existing HVAC system
g) Decommissioning of the existing Demin water system
h) Decommissioning of the existing compressed air system pipeline (blue pipe) inside the Battery room. Pipe to be blanked-off at entry to the building

The decommissioning, removal of all redundant equipment and making good where required is to include the following, however not limited to:

a) The *Contractor* is responsible for decommissioning, dismantling, removal, lifting, transport and storing (including making good thereof) of existing redundant or retired equipment to the allocated space provided by the *Employer.*
b) The scrapping of the existing equipment to the nearest scrapyard outside of Simmerpan will be the responsibility of the *Employer*. The responsibility of the *Contractor* is the removal of existing equipment, storing it and making good thereof. The storing location will be announced by the *Employer*.

The term “making good” refers to the following, however not limited to:

a) All areas where old plant or material is removed on the plant are made neat by means of closing of holes, grinding of old anchor points and welding, repainting and resurfacing.
b) The interface points between the new system and existing plant or material is made neat and functional to prevent weak points in the final delivered product e.g. the fixing of brackets and supports of interface boxes, covers, locking nuts etc.

The *Contractor* provides all scaffolding, crane, transport, etc necessary for decommissioning, dismantling, removal, lifting, transport and storing of existing redundant or retired equipment to the allocated space provided by the *Employer*; and scraping thereof.

The *Contractor* provides dust sheets and everything necessary for clearing and removal of all rubble due to the work, for the protection of the work from damage due to the operations. *Contractor* is to take adequate precautions to the satisfaction of the *Employer* to prevent damage to existing apparatus during erection operations.

The retired HVAC equipment is to be decommissioned and dismantled according to the manufactures’ instructions and the relevant codes and standards. The retired HVAC equipment containing a refrigerant is to be pumped down of both refrigerant and oil and should be labelled as containing no refrigerant as soon as it’s been decommissioned, dismantled and stored away.

Items to be removed are marked clearly before decommissioning start in order to avoid the removal of incorrect plant or material.

All existing plant that is removed is deemed re-usable and remains the property of the *Employer*.

Decommissioning and dismantling of retired HVAC equipment that may be required for future use should include the following however not limited to:

a) Disconnection of power supply and making safe thereof.
b) Disconnecting of water supply and draining of, to nearest drain point.
c) Removal of all refrigerants into approved recovery approved containers for retention or returned to the supplier or manufacturer for reclaiming as defined by SANS 10147, SANS 10250, ISO 11650, BS EN 378-4 or any relevant standard.
d) Charging of the closed loop with dry nitrogen to help prevent contamination of the system.
e) Inspection list for the equipment at regular intervals to ensure that adequate pressures are maintained, to prevent contamination.
f) The refrigerant charge where required, on larger equipment should be pumped down and isolated in the receiver or receiver condenser storage, providing valves are holding and there is a pressure relief device to protect the vessel in accordance with the appropriate code requirements.
g) Safe dismantling of the existing machines and the safe removal from site to the allocated storage area identified by *Employer.*

3.2 GENERAL REQUIREMENTS

3.2.1 Health & Safety requirements

The *Contractor* is to comply with all legislated safety requirements as well as *Employer's* health and safety standards.

3.2.2 Quality requirements

The *Contractor* is not to use Plant or Materials which are generally recognised as being unsuitable or otherwise to be avoided for the purpose for which they are intended.

Only components of high reliability are to be utilised, with a proven operating history, to enable the Plant to achieve required reliability and availability. Plant and Material design, engineering and manufacture to accord with the best modern practice applicable to high-grade products of the type to be furnished, so as to ensure the efficiency and reliability of the *Works* and the strength and suitability of the various parts for the *Works*.

Plant and Materials withstands ambient conditions and the variations of temperature arising under working conditions without distortion, deterioration or undue strains in any part.

All parts are made accurately, and where practicable, to standard gauges so as to facilitate replacement and repairs. Like parts are interchangeable.

No repair of defective Plant and/or Materials are to be permitted without the *Employer's* approval and any such repair, if approved, are to be carried out to the satisfaction of the *Employer*.

The *Employer* is free to specify hold and witness points during the installation and on-site testing stages of the project. The *Contractor* issues preliminary notification of such hold and witness points as per agreed schedule to the *Employer*, and confirms such hold and witness points at least seven working days prior to the activity.

Typical hold points are listed below:

a) Design Review
b) Factory Acceptance Test
c) Delivery to Site
d) Erection
e) Site Acceptance Test
f) All manuals and drawings (in the specified format)
g) Commissioning (*Employer* must be present)

In addition to maintaining appropriate inspection and test records to substantiate conformance to requirements, the following records are safely stored for a minimum period of seven (7) years following the final completion of the *Works*:

a) Construction, layout and component approvals
b) Type and routine test certificates
c) Construction drawings and approvals

After this period, the *Contractor* offers these records to the *Employer* (in writing) and obtains a disposal instruction.

Documentation regarding quality procedures is submitted as per agreed schedule after Contract Award. The *Employer* is review and comment on the acceptability of these documents in a time frame as per the requirements of the contract for contractual correspondence. If controlled copies of these documents have been submitted to the *Employer*, then the controlled copy numbers may be quoted in the submission.

3.2.3 Environmental requirements

Contractor is responsible for the safe disposal and provide safe disposal certificates for the following:

- Building rubble that might contain acid
- Removed light fixtures
- Old HVAC refrigerant
- Redundant electronic equipment from the storage rooms

3.2.4 Documentation requirements

3.2.4.1 Document Management

All documents supplied by the *Contractor* are to be subject to Eskom's approval. The language of all documentation is to be in English. All documentation is to be controlled and managed in accordance with Document and Records Management Procedure (32-6).

3.2.4.2 Document Identification

The *Contractor* is required to submit the Vendor Document Submission Schedule (VDSS) as per agreed dates to the delegated *Employer's* Representative. *Employer* will allocate document numbers on the VDSS and send back to the *Contractor* through the delegated *Employer's* Representative. The VDSS is revisable and changes must be discussed and agreed upon by all parties. Changes in the VDSS can be additional documentation to be submitted, changes in submission dates or corrections in documentation descriptions, document numbers, etc. The *Contractor's* VDSS is to indicate the format of documents to be submitted.

3.2.4.3 Document Submission

All project documents must be submitted to the delegated *Employer's* Representative with transmittal note according to Project / Plant Specific Technical Documents and Records Management Work Instruction (240-76992014). In order to portray a consistent image it is important that all documents used within the project follow the same standards of layout, style and formatting as described in the Work Instruction. The *Contractor* is required to submit documents as electronic using SharePoint transmittal and hard copies and both copies must be delivered to the *Employer's* Representative.

In addition, the *Contractor* is to be provided with the following standards which must be adhered to:

- Project Plant Specific Technical Documents - Handover Works Instruction 240-124341168
- Project Documentation Deliverable Requirement Specification 240-65459834
- Technical Documentation Classification and Designation Standard 240-54179170
- Project/ Plant Specific Technical Documents and Records Management Work Instruction 240-76992014

The *Contractor* list all project soft copies and hard copies for submittal on the transmittal with the following metadata fields, use *Employer's* transmittal template (240-71448626*)*:

a) Title of the document
b) Document unique identification number
c) Revision number
d) Name of discipline
e) Reason for issuing/submission
f) Sender's details
g) Sent date
h) Recipient's details
i) Date received
j) Quantity of documentation referenced on the transmittal
k) Number of copies
l) Format/medium submitted (e.g. paper, USB Stick)
m) Sender signature

n) Recipient signature, once submitted, to acknowledged receipt

The format of the final documentation handover will be specified in the Vendor Document Submittal Schedule. The Vendor Documentation Submittal Schedule (VDSS) specifies the following:

a) The limits of supply of the documentation, i.e. whether the documentation is provided / maintained by the *Contractor* or the *Employer*.
b) The type of documentation provided.
c) The software format (where applicable) in which the documentation is provided.
d) The stage in the project execution during which the documentation is provided as a deliverable.
e) The *Contractor* is to be responsible for planning the supply of the documentation during the various project stages and to provide the documentation in accordance with the Vendor Documentation Submittal Schedule (VDSS).

The documents are to be submitted to the Eskom Representative accompanied by the Transmittal Note. The *Contractor* submits all documentation to the Eskom Representative as well as the Project's Documentation Centre in the following media:

3.2.4.4 SharePoint Transmittal

Electronic copies will be submitted to Eskom Documentation Centre via the SharePoint Transmittal space that will be setup for the project.

3.2.4.5 Bulk Submission

Electronic copies large for transmitting via SharePoint (>700MB) will be delivered on USB Stick, large file transfer protocol and/or hard drives to the Project Documentation Centre. For bulk document submission, the following link can be used https://zendto.eskom.co.za/

3.2.4.6 Emails and other submission methods

Where applicable and contractually agreed, e-mail submissions can be used, as well as other submission methods employed in the relevant project e.g. Box; Norman Secure, etc.

3.2.4.7 Hard Copies

Two hard copies of documents are to be submitted to the *Employer*'s Representative accompanied by the Transmittal Note.

3.2.9The creation, issuing and control of all Engineering Drawings will be in accordance with the latest revision of engineering drawing Standard 240-86973501. Drawings issued to Eskom will be a minimum of two hardcopies and an electronic copy that is editable. The *Contractor* is required to submit electronic drawings in Micro Station (DGN) format, and scanned drawings in pdf format. No drawings in TIFF, AUTOCAD or any other electronic format will be accepted. Drawings issued to Eskom may not be "Right Protected" or encrypted. The *Employer* reserves the right to use these drawings to meet other contractual obligations. The *Contractor* is to include the *Employer's* drawing number in the drawing title block. Drawing numbers will be assigned by the *Employer* as drawings are developed.

The *Contractor* submits all drawings in accordance with the requirements stipulated in the *Employers* Engineering Drawing Standard 240-8673501. Manufacturing of the equipment commences when drawings are accepted for construction, by the *Employer*. Two paper print, editable native CAD format (.dgn) and in .pdf format of each drawing are submitted to the *Employer* for acceptance as per agreed schedule before manufacturing of equipment commences, by the *Contractor*.

The *Contractor* submits a 3D Model in DGN format. The structure of the 3D model is to be according to the Plant Breakdown Structure. The 3D model is to clearly indicate all interfaces.

The *Contractor* submits all relevant drawings, documents and design information for approval before commencing any work. After the *Employer* accepts the drawings and design information, the *Contractor* is not allowed to depart from the accepted drawings in any way except when it is with the written consent of the *Employer*.

The *Contractor* is responsible for any error or deficiency in any drawings or documents supplied by him and for any loss, damage or expense arising out of such error or deficiency, notwithstanding that such drawing or document may have been accepted by the *Project Manager*.

Drawings are submitted to *Employer* in editable native CAD format (.dgn) and in .pdf format, after commissioning of the equipment. The drawings reflect any changes made during commissioning and are submitted as "As built" drawings.

The *Contractor* notes that all General Arrangement (GA) and detailed manufacturing and erection drawings become the property of the *Employer*. The *Employer* is permitted to purchase replacement parts off these drawings from the lowest cost suppliers.

3.2.5 Configuration Management

3.2.5.1 Plant Coding and Labelling

Coding and labelling of all Plant and Materials and documentation supplied is part of the *Works* and is the responsibility of the *Contractor*. The *Contractor* is to propose a plant and labelling system which is to be accepted by the *Employer*, before any coding and labelling is to be undertaken.

3.2.5.2 Change Management

All Design change management is to be performed in line with the Eskom Project Engineering Change Management Procedure 240-53114026 and the *Employer* ensures that *Contractor* is provided with latest revisions of this procedure. Any uncertainty regarding this procedure is to be clarified with the *Employer* and clarification updates should be reflected in updated versions of this procedure.

3.2.5.3 Design Review Documentation

The *Contractor* conducts design reviews as per the *Contractor*s official design review procedure. *Contractor* further takes note of the *Employers* Design Review Procedure 240-53113685 and participates in all design reviews as specified by the *Employer*. The *Employer* may “Accept”; “Accept with Comments” or “Reject”. If required, the *Contractor* makes the necessary revisions on the documentation and ensures acceptance is obtained from *Employer*. The *Contractor* includes these design reviews as part of the schedule and suggests appropriate timing for such reviews.

3.2.5.4 Procedure for Submission and Acceptance of Contractor’s Design

The *Contractor* ensures the following:

a) The design is prepared, supervised and managed in accordance with the *Employer*’s principles and quality procedures.
b) The design is prepared, reviewed and verified by individuals who are competent and are registered with ECSA or other international recognised bodies,
    a. The SAQCC design requirements for Fire detection and protection design work certificates.
c) The design of the *Works* complies with the Contract Specification, generic specifications, standards, drawings, the *Project Manager*’s instructions and other documents.
d) The design is accurately recorded in the design submissions including calculations, verifications, detailed construction drawings, specifications, test and commissioning plans and operation and maintenance manuals.
e) The design is reviewed and endorsed as compliant by an internal Reviewer prior to sending it for verification by the *Employer*.

f) The design is developed and submitted for review in accordance with the Contract Specification and agreed schedule.
g) All design information, data, drawings and other documentation is produced for the *Works* in accordance with the Contract.
h) The Detail design report is to be according to the *Employer*'s Detail Design Report Template, 240-49910707.

3.2.5.5 Design Review Procedure

The *Contractor* is the Design Authority for the entire *Works*, including any Controls, Electrical, Civil, Structural and Building related *Works* of the contract as defined in the *Employer's* Design Review Procedure 240-53113685. The *Contractor* is responsible for following this design procedure and conducts all the design reviews as specified in this procedure. The *Contractor* is responsible for conducting the following reviews:

a) Design Freeze Review (Detail Design)
b) Pre-Commissioning Review
c) Acceptance Testing Review
d) Handover Review

For design review purposes the designs will be reviewed per part of the *Works* as well as an integrated design where all interface issues between the various parts are addressed as follows:

a) The interim design stage will be an iterative process between the *Employer* and the designer with regular progress meetings.
b) The interim design stage will culminate with the submission of a report.
c) After receipt of the design report, the *Employer* will have ten (10) working days to review and submit comments to the designer.
d) The designer will then have five (5) working days to submit the updated final design report.
e) The submission will then constitute the End of Phase review and the *Employer* will accept the final design report with comments by the *Employer* and updates by the designer within five (5) working days.

3.2.5.6 Process for Submission of Documents

The *Contractor* submits all documents according to the templates that are referenced on the list of Standards. The process for the submission of documents is described below:

a) The *Contractor* submits the documents/drawings to the *Employer*.
b) The *Employer's* Document Controller registers the documents.
c) The *Employer's* Document Controller will supply the documents/drawings to all relevant parties within the *Employer*'s project team.
d) The *Employer's* project team reviews the documents/drawings and will submit all comments or inputs to the *Employer* and the *Employer* submits to the *Contractor* for consideration.
e) If the *Employer* finds major deficiencies in the submitted documents/drawings, the *Contractor* revises the documents/drawings and resubmits to the *Employer*.
f) The *Employer* reviews the documents/drawings and if no major deficiencies are found, the *Contractor* organises a Design Review session.
g) The *Employer* and the *Contractor* conduct a Design Review.
h) If any fundamental errors were found in the designs or further actions are required, the *Contractor* record all concerns raised and revises the designs.
i) The *Contractor* organises a Design Review session once all designs were revised according to the concerns raised by the *Employer*.
j) If no fundamental errors were found in the designs during the Design Review session, the *Contractor* compiles the Design Review minutes or report and submits it to the *Employer*.
k) The *Employer's* Document Controller registers the report.

l) The *Employer's* project team reviews the *Contractor's* report/minutes. If the report/minutes are not acceptable, the *Contractor* revises the report/minutes and resubmits to the *Project Manager*.
m) The *Project Manager* accepts the *Contractor's* design once the report/minutes are accepted by the *Employer's* project team.

The *Contractor* is to implement the following activities for approval:

a) The *Contractor* reviews, stamps, dates and signs to signify his/her approval and submit in the manner required by the *Employer* in orderly sequence so as to cause no delay in the work, all *Contractor's* drawings, equipment selections and/or samples required by the *Works* or subsequently by the *Employer*. *Contractor's* drawings, equipment selections and samples are to be properly identified as specified or as the *Employer* may require.
b) At the time of submission, the *Contractor* informs the *Employer* in writing of any deviation in the *Contractor's* drawings, equipment selection or samples from the requirements of the *Works*.
c) Each individual plant and material selection submission is to be accompanied by a copy of the applicable detailed technical specification. Each clause of this specification to be marked "Complies" or "Does not comply", complete with reason stated, alternative offered and countersigned by the *Contractor*.
d) Plant and material selection submissions are to be indexed similar to the index for plant and material part of the "Operating Instructions and Maintenance Manual".
e) The *Contractor* is to submit two copies of drawings and plant and material selections along the channels agreed.
f) By submitting drawings, plant and material selections and/or samples, the *Contractor* represents that he/she has determined and verified all site measurements, site instruction criteria, materials, catalogue numbers and similar data, and that he/she has checked and co-ordinated each services drawing and sample with the requirements of the *Works*.
g) The *Employer* reviews *Contractor's* drawings, plant and material selections and samples so as to cause no delay, but only for conformance with the design of the *Works*. The *Employer's* approval of a separate item does not indicate approval of an assembly in which the item functions.
h) The *Contractor* makes any corrections required by the *Employer* and re-submits the required number of corrected copies of the *Contractor*'s drawings, plant and material selections or new samples until approved. The *Contractor* directs specific attention in writing on resubmitted drawings to revisions other than the corrections required by the *Employer* on previous submissions.

The following documents are supplied to the *Employer* by the *Contractor* as a minimum:

a) Documents, including detailed calculations where needed.
b) Documents including equipment data sheets and specification for selected equipment, electrical cabling and other associated equipment.
c) Dimensioned shop drawings showing the general arrangement of all plant and equipment including isometrics and P&ID's or PFD's where required. Sufficient views must be given to ensure clarity and the drawings are to have at least a plan and two different elevations or sections giving overall dimensions.
d) Dimensioned shop drawings showing proposed method of fixing of all the plant and equipment
e) Detailed electrical wiring diagrams including schematic and control circuits.
f) Compliance and Electrical Certificates
g) Detailed sequencing manner for installation procedure of *Works*
h) Detailed programme for the *Works* in sufficient detail as to represent the units of work to enable the representative to assess the progress of the *Works*
i) Technical specification and literature for all items of equipment that forms part of the complete installation
j) Proposed corrosion protection systems, including data sheets for coating proposed of equipment
k) List of recommended spares and technical specifications for the spares, part numbers and the stock levels required
l) Detailed building *Works* for complete *Works*

m) Detailed maintenance, reliability, control and operating philosophies
n) Testing, balancing and commissioning procedures
o) Plant and material acceptance testing
p) Detailed operation & maintenance manuals with As-Built drawings & Commissioning Results
q) Plant codification lists for each section of the *Works*
r) Construction competition reviews
s) Acceptance testing reviews
t) Quality assurance reports
u) Close out reports
v) All documentation required to obtain an Occupancy Certificate (supplied in package format)
w) As-Built drawings

3.2.5.7 Time Required for Acceptance of Designs

The *Project Manager* will return one copy of the drawing marked “Accepted”; “Accepted with Comments” or “Rejected”. as may be appropriate.

The notations “Accepted” and “Accepted with Comments” authorize the *Contractor* to proceed with the manufacture of the Plant covered by such drawings subject to the corrections, if any, indicated thereon.

Where prints or drawings have been “Rejected” or “Accepted with Comments” the *Contractor* makes the necessary revisions on the drawings and submit further copies for acceptance in the same procedure as for the original submission of drawings.

Every revision shows by number, date and subject in the revision block on the drawing.

The *Contractor* is to allow for 10 calendar days for review of documentation by the *Project Manager.*

Design to be reviewed and approved by Eskom Engineering prior to starting of the Works.

3.2.6 Communication requirements

As specified in the NEC document

3.2.7 Other requirements (Process/Legislative/Contractual)

None

APPENDIX A: 0.54/1150